or strut or flap their wings and squawk. Let them push each other about, or swim, or sit still and blink in the sun, as they will. Let them otherwise develop their lives—for they sometimes bring us truth and beauty quite beyond what most men call golden.

MICHAEL AMRINE
American Psychological Association,
1333 16th Street, NW,
Washington 6, D.C.

Michael Amrine is author of The Great Decision *(Putnam, New York, 1959).*—ED.

Responsible Scientific Choice

Alvin Weinberg's criteria for responsible scientific choice, and his suggestions for improving our system of making choices, are not only sound but inspiring. What prompts me to write, however, is your singling out of one of Weinberg's arguments as "particularly apt" in your editorial of 13 September. This is the idea that the field with most scientific merit is one which contributes "most heavily to and illuminates most brightly its neighboring scientific disciplines."

If this and the other criteria offered by Weinberg are valid, it seems to me that the NASA space program, or at least most of its scientific component, comes off rather well. Space science seems to meet, at least adequately, all the criteria mentioned in your editorial.

I think "space science" measures up quite well mostly because, one could say, so little exists that is "space science" in itself. Earth satellites serve geophysics and its sisters and cousins —upper-atmosphere and ionospheric physics, geomagnetics, and others. Both earth satellites and deep-space probes serve solar physics, astrophysics, and solar-system astronomy—the last having been rather neglected for decades because the earthbound tools we have had could do more in galactic and extragalactic astronomy. Space tools will serve galactic and extragalactic astronomy as well, along with cosmology and (once lunar landings have been made) even geology once again.

Unless its development is throttled, the space program shows promise of determining within a few years whether vital spores of any kind can be found on the moon or in space itself. Within a few years after that, the question of life on Mars will surely be "settled." Certainly "settling" these gross questions will raise many more provocative questions for biology—and probably most of all for molecular biology. The Space Administration seems to be preparing to meet these questions: it was at the NASA Ames Center here in California that ATP was first synthesized.

Certainly the answer is "yes" for both of Weinberg's "internal" criteria: "(1) Is the field ready for exploitation? (2) Are the scientists in the field really competent?" To laymen, the answer might seem to be "no" for the second, because of the early failures in making pre-NASA and NASA hardware work. But the scientists who designed the payloads knew what they were instrumenting for, how to instrument for it, how to retrieve the data, and what to do with the data. This adds up to competence, whatever the engineering difficulties.

Whether or not space activities can be promoted or defended on the three "external" criteria of "technological merit, scientific merit and social merit" depends greatly on the point of view. Some critics seem to begin with an a priori principle that space activities are simply not worth the candle, and it is impossible to show them evidence of merit; they have defined the merit away. At the other extreme are what are best termed "space fans," for whom space activities are a "race"; they are always eager to have *Ourside* do something Bigger, Better, and Firster than *Theirside.*

Space has stimulated interest in science, among laymen generally and among school children (and their teachers) in particular, more than any other scientific development in modern times. To most people, nuclear energy is just bombs, and particle physics is more bombs; chemistry used to be nylon and buffered aspirin. It was the traumatic opening of the space age that brought a real and deep ferment in education; this ferment has not produced much yet, but it is going on at the usual *social* pace—not the pace of science or technology. Space offers mankind an opportunity to channel deep, unconscious, irrational competitive drives into directions other than toward warfare—though the opportunity may be missed. It can be missed if we go on arguing whether we would rather have a lunar landing or a cancer cure (or some other "more worthy" objective); we all know in our hearts that these things are not alternatives. Space also, as Eugene Rabinowitch recently pointed out, offers unprecedented opportunities for international cooperation. Even this much adds up to social merit.

As for scientific merit, "space science" not only serves and illuminates its neighbor sciences but also stimulates science in general and stimulates support for science. Would there be bitter and prolonged disputes today over $10 million for a Hale-Palomar observatory or a preliminary Mohole drilling? The sheer size of the space effort has made "unreasonably" expensive ventures "reasonable." The head of a great oceanographic institute informs me that his budget has tripled in the last few years, and he thinks "space has helped."

The "trouble" with space science is that it requires such frightfully expensive hardware. But this general kind of hardware is being built anyway, for its destructive potential. Without deliberate space efforts it would not serve science directly at all, and it serves society only by providing a deterrent to someone else's destructive use of similar hardware. Or so society hopes. No worthwhile suggestions have been made for getting cheaper hardware or for using the expensive stuff more efficiently; we shall learn how to do these things by using what is available "inefficiently" for a time. Certainly we shall not have cheaper space programs by stretching them out, or waiting indefinitely. Nor would stretchouts or arbitrary waiting periods serve society any better right now when we have idle industrial capacity and people out of work—and while we can still afford unlimited supplies of lipstick and pizza.

NICHOLAS ROSA
1010 Noel Drive,
Menlo Park, California

Research Grants—Are They Worth Saving?

The recent recommendations of the Committee on Sponsored Research of the American Council on Education relative to payment of faculty salaries from research grants deserve very serious consideration from the academic community and government agencies. These proposals represent a further step in the direction of approaching all university research support on a strict contractual basis. They also represent a step away from the view that the faculty members of universities have scholarly interests for which they seek financial help and for which they